# Vulnerable Road Segments

## King County Road Services Division

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# Vulnerable Road Segments

## *Introduction – what is VRS and how were the segments identified?*

The Vulnerable Roadway Segments (VRS) study was instituted to address concerns over unknown roadway funding needs throughout the County. King County's roadways have suffered repeated failures requiring emergency repairs following storm events. These failures have led to a growing concern that King County had an unknown and un-quantified cost associated with so-called vulnerable roads. In order to address this issue the Engineering Services Section was asked to initiate this study.

The overall goal of the study was to identify, quantify, and prioritize vulnerable road segments throughout the County and program future projects in maintenance and capital programs. For this study, a vulnerable road segment is defined as any road segment that is abnormally expensive and/or needing frequent repair. Examples are roads with failing retaining walls, seawalls, roads with chronic settlement problems, or roadways close to rivers with repetitive erosion problems.

The first step of the study was to identify the vulnerable road segments throughout the County. The identification process consisted of researching existing lists of problem roads as well as identifying new segments with problematic features. The Planning Section and the Materials Lab of the Engineering Services Section along with the four divisions of the Roads Maintenance Section all identified areas that had frequent maintenance needs.

The Planning Section routinely identifies roadway segments in the county for future road and traffic safety improvements and summarizes their findings in the Transportation Needs Report (TNR). Several of the vulnerable roadway segments were identified in the 2004 TNR as future project candidates. The TNR categorized the road projects with the following needs; capacity projects, high accident locations, high accident road segment, intelligent transportation system corridor, guardrail needs, signal priority needs, and pedestrian needs.

Although the Planning Section had good information on roads they considered vulnerable, their information database was focused on capacity upgrades and accident reduction needs. The data for the TNR was developed towards complete corridors and less towards specific road segments.

The data the Materials Lab provided was more informative for this study. It provided a detailed list of all the unstable slopes and areas that had been

repaired or were being monitored. It acted as a good crosscheck for the data later obtained from the maintenance divisions.

The Maintenance Divisions proved to be a valuable resource for identifying new road segments of interest. A short worksheet was created and meetings were held with each of the four maintenance divisions within the County. Each division provided a detailed list of the vulnerable road segments within their area. Detailed information on the location of the segment, the reason the segment was vulnerable, and the repairs performed to date were documented. Site visits were then conducted for many of the locations. The site visits gave the project team a chance to get a good idea of the extent of the problem and gather photos of each segment.

The information from the Engineering Services Section as well as the coordination and site visits with the Maintenance Divisions provided enough information to compile a database of 63 vulnerable roadway segments.

## *The Vulnerable Road Segments Database – what was compiled for each segment?*

The project team created a database to compile and analyze the collected vulnerable road segment data. Fields for each of the 63 road segments in the database included:

- The segment location,
- A description of the road segment,
- Traffic data on the segment,
- An engineering assessment of the problem and,
- The estimated cost to remedy the problem.

Several traffic fields were included in the database such as roadway classification, average daily traffic counts, guardrail information, and detour lengths. Roadway classification data and nearby traffic counts were useful in estimating average daily traffic counts when no traffic count existed for the road segment. Knowing the roadway classification also helped in prioritizing the projects by assigning less importance to access streets than arterial or collector roads. Further definition of the road segments' importance stemmed from the detour length.

The vulnerable roadway database included a traffic safety element by identifying segments that need guardrail. Road segments with safety needs were prioritized higher than other segments that did not need safety improvements.

## *Problem Categories – what's the problem with the segment?*

Each of the road segments was grouped into one of six problem categories. These categories helped identify possible environmental impacts and helped to estimate project environmental permitting costs.

1. *Steep Slopes* – the roadway is built into a steep slope with landslide potential *below* that could compromise the support of the roadway.

2. *Landslide* - the roadway is below a steep slope with landslide potential *above* that could bury the roadway.

3. *Seawall* - a structurally deficient seawall supports the roadway prism. Failure of the seawall would likely compromise the support of the roadway.

4. *River Erosion* - erosion of the roadway prism situated along the riverbank could compromise the roadway.

5. *Flood* - heavy rain events could submerge a segment of the road and erode the roadway prism, causing the road to become unusable.

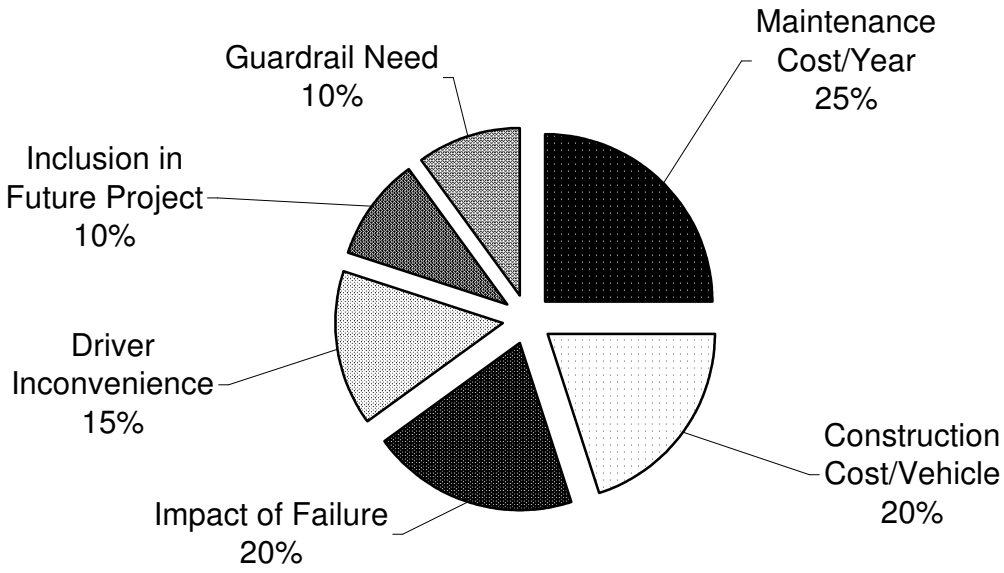
6. *Roadway Settlement* - the road base soils have large differential settlements causing an uneven roadway surface.

## *Priority Ranking – what factors determined the final priority of the segment ranking?*

The factors shown in the pie chart below were used in developing the priority rank formula for vulnerable roadway segments. The value assigned to each of the factors was either calculated or collected from various data sources. The percentage of influence each category has in producing the priority rank is shown in the pie chart below.

The factors were chosen by the project team and refined through an iterative process. After each iteration, the values and percentages of the factors, as well as the segment rankings were studied for reasonableness. The overall goal was achieved when the full numerical range of each factor was well distributed among the segments and the weighting percentage of each factor seemed to result in a logical ranking of segments.

## Priority Ranking Factors




The Maintenance Cost / Year is the average estimated amount of money spent each year *repairing* the road segment to correct the identified problem in the short term. Projects with higher annual maintenance costs are given more priority.

$$Factor = \frac{M \times f}{20{,}000} \times 25$$

*where M = estimated maintenance cost/year (in thousands of dollars)*
*f = the frequency of the maintenance each year*
*20,000 = the maximum maintenance cost/year*
*25 = the maximum number of points possible for this factor*

The Construction Cost / Vehicle factor divides the cost of the *permanent* construction fix (i.e., not a maintenance repair) by the average daily number of vehicles that travel the road. Projects with a lower cost benefiting a higher number of vehicles are given a higher priority.

$$Factor = 20 - \frac{C / ADT}{1500} \times 20 \quad (Factor = 0 \text{ if formula results in negative value})$$

*where C = cost of permanent construction fix*
*ADT = average daily traffic count on segment*
*1500 = highest C/ADT ratio, except for a few outliers (1500 chosen to keep this factor well distributed among segments)*
*20 = maximum number of points possible for this factor*

The Impact of Failure factor accounts for the importance in correcting a vulnerable roadway segment. The project team made many field visits evaluating the majority of the vulnerable roadway segments, classifying the roadway problem, and performing a preliminary engineering assessment to score the roadway vulnerabilities. Each of the road segments was scored 1 to 5 addressing the predicted consequences if no action were taken to correct the problem. The scoring is as follows:

Score = 1 If problem is left uncorrected, total failure would likely occur, resulting in closure of the entire road.

Score = 2 If problem is left uncorrected, partial (or possibly total) failure of the road could occur, closing half (or all) of the road.

Score = 3 If problem is left uncorrected, partial failure of road could occur, closing a shoulder and/or possibly a lane of the road.

Score = 4 If problem is left uncorrected, minor loss of road function could occur in near future.

Score = 5 If problem is left uncorrected, maintenance would be necessary with no foreseeable loss of road function.

*If Score = 1, Factor = 20*
*If Score = 2, Factor = 11*
*If Score = 3, Factor = 6*
*If Score = 4, Factor = 3*
*If Score = 5, Factor = 0*

*Values of factors determined by an exponential function (as opposed to a linear function), to weigh full or partial road closures much more heavily than a minor loss of road function.*

The Driver Inconvenience factor of each road segment measures the overall level of driver inconvenience if a vulnerable road segment is closed. The detour length and the traffic volume on the segment is considered in this factor. Segments involving longer detours with higher traffic volumes are given more priority.

$$Factor = \frac{l \times ADT}{95{,}000} \times 15$$

*where* $l$ = *length of detour caused by closed road segment*
$ADT$ = *average daily traffic on segment*
95,000 = *maximum l/ADT ratio (except for one outlier)*
15 = *maximum number of points possible for this factor*

If a segment is part of a planned project in the CIP or TNR, the Inclusion in Future Project factor gives priority to such segments to account for the opportunity to complete two needs with one project.

*Factor = 10 if segment included in other project*
*Factor = 0 if segment not included in other project*

The Guardrail Need factor is a yes or no toggle identifying the need for guardrail on the vulnerable segment. Road segments slated for future guardrail projects are given more priority to account for the opportunity to fulfill two needs with one project.

*Factor = 10 if guardrail is needed on segment*
*Factor = 0 if guardrail is not needed on segment*

All of the priority ranking factors are then weighted to the percentages shown in the pie chart above and summed to produce a score between 0 and 100, ranking the different road segments and identifying the best project candidates. The road segments with the lower scores are the best candidates for road projects.

### *Sample calculation*

The following sample calculation for vulnerable segment of NE Woodinville Duvall Road (steep slopes above and below roadway) will help illustrate how the final rating scores were calculated:

*Maintenance Cost / Year (25 points max.)*

$$Factor = \frac{M \times f}{20{,}000} \times 25 = (\$10{,}000 \text{ x } 0.5 \text{ times/year}) / 20{,}000 \text{ x } 25 = \mathbf{6}$$

Score is only 6 out of 25 due to relatively inexpensive repairs at infrequent frequency - once every two years.

*Construction Cost / Vehicle (20 points max.)*

$$Factor = 20 - \frac{C / ADT}{1500} \times 20 = 20 - (\$420{,}000 / 11{,}100 \text{ vehicles / day}) / 1500 \text{ x } 20 = \mathbf{19}$$

Score is a high 19 out of 20 due to relatively inexpensive permanent fix for large volume of vehicles.

*Impact of Failure (20 points max.)*
*If Score = 3, Factor = **6***

Score is only 6 out of 20 due to lower impact of problem, which would close a shoulder of the segment, or one lane at worst. Traffic would not need to be detoured.

*Driver Inconvenience (15 points max.)*

$$Factor = \frac{l \times ADT}{95{,}000} \times 15$$ *= (8.5 mile detour x 11,100 vehicles / day) / 95,000 x 15 = **15***

Score is a full 15 out of 15 due to lengthy detour affecting a large volume of vehicles.

*Inclusion in Future Project (10 points max.)*
*Factor = **10** (segment included in operational project identified in TNR)*

Score is a full 10 points because it has also been identified as a need in another study.

*Guardrail Need (10 points max.)*
*Factor = **0** (guardrail is not needed on segment)*

Factor is zero since there is no need for guardrail on this segment, meaning two projects cannot be completed due to action on this segment.

*Total Score*
*6 + 19 + 6 + 15 + 10 + 0 = 56*

*Total Rating (lower score is better candidate for action)*
*100 – 56 = **44** (actually 43 due to rounding in spreadsheet)*

## *Results – The Top Twelve Candidates*

The following projects had the lowest rating scores and therefore, are the most favorable projects for future construction.

1. **Dockton Road SW failing seawall (south portion)** – Despite the high cost of permanently fixing this roadway segment with a new seawall, this project has the highest priority ranking due to the impact of the failure (seawall failure results in a total road closure) and the high cost of repairs, especially in the 2005-06 winter season. Guardrail is also needed for this

project. The condition of this 68-year old seawall is very poor and the wall has exceeded its useful life.

2. **Peasley Canyon Way S. steep slope instability** – this segment requires frequent and costly maintenance and has a rather low cost/vehicle cost for a permanent fix, making this segment an attractive candidate for a permanent fix. It is also included in the TNR. Construction involves building a ten-foot high x 1600-foot long retaining wall to prevent minor slides on the slopes above the roadway from blocking traffic.

3. **SE Newport Way at Eastgate Park plugged culverts** – plugged culverts crossing under this segment could be replaced with a 30-foot long bridge, eliminating the current need for frequent and costly maintenance.

4. **Issaquah Hobart Road creek erosion** – This vulnerable segment of roadway did indeed fail during the above average rainfall of January 2006 with Issaquah Creek undermining the roadway, resulting in a road closure for several days until emergency repairs were complete. This VRS candidate has been struck out on the data spreadsheet since a permanent rockery has removed the vulnerability from this location.

5. **W. Snoqualmie Valley Road flood damage** – When the Snoqualmie River floods, various portions of this road become flooded causing culverts to clog and portions of the roadway to slump. A long detour coupled with moderate traffic volumes raises this priority.

6. **Upper Preston Road landslide** – water flows through a steep slope above this roadway causing frequent slides onto the roadway. This segment scores favorably because it requires frequent and costly maintenance but has a low construction cost since a relatively short 100-foot wall will fix the problem. In addition, the road is sole access to hundreds of homes, resulting in a high driver inconvenience score should a major slide block residents' only access to their homes.

7. **Dockton Road SW failing seawall (north portion)** – while not as vulnerable as the south portion of this seawall, this stretch of roadway is subject to shoulder erosion during high tide, high wind events. It is very similar to the south portion seawall except for its lower maintenance costs. The condition of this 68-year old seawall is very poor and the wall has exceeded its useful life.

8. **NE Woodinville-Duvall Road steep slope instability** – steep slopes both above and below this arterial can disrupt major traffic volumes when storms hit. Installing 10-foot high walls along both sides of this segment would resolve the vulnerability. This segment is also identified in the TNR

9. **SE Newport Way at 151st Ave. SE plugged culverts** – this segment is identical to the candidate above except the consequences of this problem do not have as high a potential to disrupt traffic, resulting in a lower impact of failure score. A 30-foot bridge will remove this vulnerability.

10. **Fay Road steep slope instability** – steep slopes above this roadway segment cause frequent and costly maintenance. While the impact to drivers is not great, this area nonetheless needs to be cleaned up after storms. Construction of a relatively inexpensive 10-foot high x 200-foot long wall would take care of the problem once and for all. Guardrail is also needed at this location, raising the ranking of this segment.

11. **Vashon Highway seawall pocket failures** – high maintenance costs, the need for guardrail, and the impact of a seawall failure on this arterial put this project high on the vulnerable roadway list. This rockery is prone to "pockets" of failures as the poor quality rock continues to split and unravel onto the beach, exposing segments of the wall to wave erosion. The southwest-facing orientation of the rockery exposes it to the worst of winter storms. Replacement costs are high and a recent CIP effort to replace the wall with a grant from the Army Corps of Engineers was stymied when the Corps ruled that a wall replacement was not economically feasible.

12. **Union Hill Road steep slopes** – although annual maintenance costs are relatively low, an inexpensive retaining wall at this site would correct the problem permanently. The identification of this segment as a HARS candidate keeps this project in the top twelve.

## *Conclusion and Recommendations – where do we go from here?*

This VRS study has identified and ranked the most feasible roadway segments for future capital projects. To be an effective planning tool, this study will need to be updated periodically to reflect the current state of the county's roadway infrastructure. The completion of some projects, the introduction of others, and the ever-changing needs identified in the TNR will likely change the ranking of projects every time this study is updated.

It is recommended that this VRS study be updated every two years, to incorporate data from interim revisions of the TNR and to capture the most recent roadway information, such as traffic volumes, maintenance costs and frequencies, and permanent construction costs.

# Vulnerable Road Segments

| No. | Segment No. (Thos. Bros.) | Road Carried | Segment Start | Segment End | Seg-ment Length | Problem | Description of problem | Road Classi-fication | Construction Costs | Proposed Repair | **Total Rating (low = better candidate)** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3683H5A | Dockton RD (south portion) | Portage Way SW | Tramp Harbor Dock | 1700 | Seawalls | Seawall of mixed construction types inadequately supports road prism. | Collector | $7,990,000 | Replace seawall @$4700/ft | **34** |
| 2 | 3745F6 | Peasley Canyon Way S | S. Peasley Canyon Rd. | Military Rd. S. | 1600 | Steep Slopes | Most of the slide problem along S. Peasley Canyon Rd has been repaired as part of the Hwy 18 Project. Some minor slope problems still exist along the west side of Peasley Canyon Way S. | Collector | $480,000 | Retaining wall 10' high | **37** |
| 3 | 2596J4 | SE Newport Way | Eastgate Park | Eastgate Park | 500 | Flood | The cross culverts under the roadway plug with debris during heavy rains. | Principal | $500,000 | 30 ft Bridge | **39** |
| 4 | ~~4658G4~~ | ~~Issaquah Hobart Rd~~ | ~~SE 200th~~ | ~~SE 200th~~ | ~~200~~ | ~~River Erosion~~ | ~~During high water the slope tends to move downward because of toe erosion from the creek.~~ | ~~Collector~~ | ~~$100,000~~ | **Failed During 2006 Rainstorms - REPAIRED** | ~~**40**~~ |
| 5 | 2478E4 | W. Snoqualmie Valley Rd. | Snohomish County Line | Ames Lake Carnation Rd | 46464 | Steep Slopes | There are numerous slide areas along the length of the roadway. The slides plug cross culverts which causes the roadway to slough from water flowing across it. | Principal | $2,820,000 | 10ft tall wall (Length=4700ft) | **40** |
| 6 | 2629C5 | Upper Preston Rd | SE 97th St | SE 97th ST | 100 | Land Slide | Water is flowing through the steep slope above the roadway causing the slope to slide regularly. | Local | $250,000 | 30ft tall wall | **42** |
| 7 | 3683H4 | Dockton RD (north portion) | Tramp Harbor Dock | SW Ellisport RD | 2000 | Seawalls | Seawall of mixed construction types inadequately supports road prism. | Collector | $9,400,000 | Replace seawall @$4700/ft | **43** |
| 8 | 1478D7 | NE Woodinville-Duvall Rd | Old Woodinville-Duvall Rd | W. Snoqualmie Valley Rd | 350 | Steep Slopes | Steep Slopes above and below the roadway | Principal | $420,000 | Walls both sides 10ft tall | **43** |
| 9 | 2597A4 | SE Newport Way | 151st Ave SE | 155th Pl SE | 500 | Flood | The cross culverts under the roadway pug with debris during heavy rains. | Principal | $500,000 | 30 ft Bridge | **44** |
| 10 | 2539B2 | Fay Rd | SR 203 | 302nd Way NE | 200 | Steep Slopes | There are steep slopes above the roadway that slide during rain events. | Collector | $300,000 | 10ft tall wall | **46** |
| 11 | 3713E1 | Vashon Highway | 115th Ave SW | SW 240th Pl | 3200 | Seawalls | Seawall rockery has numerous localized failures every year. | Principal | $8,000,000 | Replace seawall @$2500/ft | **52** |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| 12 | 1537G4 | Union Hill Rd | 196th Ave NE | 206th Pl NE | 450 | Steep Slopes | Needs Bank Stabilization | Principal | $135,000 | 10ft tall wall | **53** |
| 13 | 4657D5 | Jones Rd | 17800 Block | 17800 Block | 500 | Land Slide | The hillside above the roadway slides filling the ditchline with material | Collector | $500,000 | Failed During 2006 Rainstorms – 10 ft tall wall | **54** |
| 14 | 2661F4 | SE Lake Dorothy Rd | SE Middle Fork Rd | SE Middle Fork Rd | 20400 | Steep Slopes | There are steep slopes above and below the roadway that slide during heavy rain events. | Local | $12,240,000 | Walls both sides 10ft tall | **55** |
| 15 | 3683H5B | Quartermaster Dr | 1/4M E of Monument RD SW | Portage Way SW | 220 | Seawalls | Seawall of mixed construction types inadequately supports road prism. | Collector | $330,000 | Replace seawall with rockery @ $1500/ft | **55** |
| ~~16~~ | ~~4657A4~~ | ~~154th Place SE~~ | ~~Jones Rd~~ | ~~North of Jones Rd 2000ft~~ | ~~2000~~ | ~~Flood~~ | ~~Culvert plugs during rain events and causes water to erode the roadway.~~ | ~~Collector~~ | ~~$0~~ | **REPAIRED during Elliott Bridge Replacement** | ~~**56**~~ |
| 17 | 2630E3 | SE Reinig Rd | Mill Pond Rd | 396th Dr SE | 1600 | Flood | The roadway shoulders washout during flood events. | Principal | $96,000 | Armor Shoulders @$100/cyd | **58** |
| 18 | 2599C2 | SE 24th ST | 309th Ave SE | W. Snoqualmie River Rd | 1000 | Flood | The roadway shoulders washout during flood events. | Collector | $60,000 | Armor Shoulders @$100/cyd | **58** |
| 19 | 4746F6 | Auburn Black Diamond Rd | Near Fish Hatchery | 12700 Block | 1500 | Flood | Ditchline along roadway plugs and water overflows the roadway | | $12,000 | Routine Maintenance After Heavy Rains | **58** |
| 20 | 2599B3 | 308th Ave SE | SE 31st ST | SR 202 | 1000 | Flood | The roadway shoulders washout and the ditches fill with debris during flood events. | Collector | $60,000 | Armor Shoulders @$100/cyd | **58** |
| 21 | 3715F6 | S. Starlake Road | S. 272nd Way | 52 Ave S. | 528 | Land Slide | Steep slopes above the roadway slide every year plugging the ditch line. | Local | $75,000 | None - periodic maintenance req'd | **60** |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| 22 | 1505J3 | Holms Point Drive NE | At 144th | At 144th | 50 | Steep Slopes | The banks of the roadway are unstable | Collector | $150,000 | Wall on downhill side 10ft tall | **60** |
| 23 | 1506A6 | Juanita Drive NE | Holms Point Drive NE | NE 118th St | 30 | Steep Slopes | The banks of the roadway are unstable | Principal | $75,000 | Walls downhill side 20ft tall | **60** |
| 24 | 3746C3 | 104th Ave SE | Leahill Rd SE | 304th Way SE | 2000 | River Erosion | The Green River flows along the edge of the roadway. The river is slowly eroding soil from the road base causing the road to slowly slide into the river. | Collector | $500,000 | River dike is armored, add filter fabric and more armor | **61** |
| 25 | 2569B3 | W. Snoqualmie River Rd | NE Tolt Hill Rd | SE 24th St | 21120 | Flood | The entire roadway is flood prone and the shoulders wash out due to the flood waters. | Collector | $1,267,200 | Armor Shoulders @$100/cyd | **61** |
| 26 | 2630C3 | Mill Pond Rd | SE Stearns Rd | SE Reinig Rd | 7300 | Flood | The roadway floods often and the roadway shoulders washout. | Collector | $438,000 | Armor Shoulders @$100/cyd | **61** |
| 27 | 1507A3 | 146th Pl NE | SR 202 | 155th Ave NE | 50 | Land Slide | The banks of the roadway are unstable | Collector | $100,000 | 15ft tall wall | **61** |
| 28 | 4687F4 | Petrovitsky Rd | 196th Ave SE | 1000ft East of 196th Ave | 1000 | Flood | Roadway Floods | Collector | $2,000,000 | Raise Roadway | **62** |
| 29 | 2569C2 | NE Tolt Hill Rd | Tolt Hill Bridge | SR 203 | 1600 | Flood | The roadway shoulders washout and the ditches fill with debris during flood events. | Principal | $96,000 | Armor Shoulders @$100/cyd | **62** |
| 30 | 3745D2 | S 304th St | 32nd Ave S. | 37th Ave S. | 2500 | Flood | This section of the road is flooded by a wetland along both sides of the road. | Collector | $150,000 | Armor Shoulders @$100/cyd | **63** |
| 31 | 4688A7 | Dorre Don Way SE | SE 224th | Se 224th | 300 | Land Slide | Slope drops material into ditchline and onto roadway | Local | $500,000 | Failed During 2006 Rainstorms, No repair recommended | **64** |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| 32 | 4657J4 | Maxwell Rd | Se 206th St | Se 208th St | 200 | Flood | Water cross the roadway during minor flooding conditions. Depth of water varies 1" to 6". | Local | $12,000 | No proposed project due to Floodplain Permits and Low ADT | **64** |
| 33 | 3775F3 | 58th Place S./56th Place S. | West Valley Road | West Valley Road | 5280 | Land Slide | The road is very curvy and narrow. The road provides a shortcut from West Valley Highway to the surface streets above. There are steep slopes above and below the road along its entire length. | Local | $20,000,000 | Major Roadwork Needed, Possible Re-alignment | **65** |
| 34 | 3653E1 | Cedarhurst Rd | 1/4M N of W Cedathurst RD | 1/16M S of SW 134th PL | 25 | Steep Slopes | Timber Crib wall has failed. | Collector | $20,000 | 10ft tall wall | **66** |
| 35 | 4657F6 | 196th Ave Se | SE 161 | SE 170 | 2700 | Steep Slopes | Hill slide leaving cracks in roadway | Collector | $810,000 | Retaining wall 10' high | **67** |
| 36 | 4687C6 | SE 224th | 172nd Ave SE | 172nd Ave SE | 200 | Flood | Roadway floods | Collector | $12,000 | Armor Shoulders @$100/cyd | **68** |
| 37 | 3683H3A | Chautauqua Beach RD SW | SW Ellisport RD | SW 206th PL | 200 | Seawalls | Gabion wall has toe scour and has rotated along the length of the wall. Steel has corroded and rock has begun to fall out of gabion. | Local | $120,000 | Replace seawall @$600/ft | **69** |
| 38 | 1538B5 | Union Hill Rd | 229th Ave NE | 238th Ave NE | 3075 | Land Slide | Needs bank stabilization on uphill side. Falling rock hazard. | Principal | $1,845,000 | 20ft wall | **70** |
| 39 | 4749E3 | SE Courtney Rd | Kanasket Kangley Rd SE | 337th Pl SE | 100 | Flood | During heavy rain events the drainage system plugs with rock and other debris causing water to overflow the roadway. | Local | $75,000 | Routine Maintenance After Heavy Rains | **70** |
| 40 | 2163J9 | North Fork Rd SE | Wagners Bridge | Wagners Bridge | 100 | Land Slide | Steep slope above roadway that slides after heavy rains. | Local | $75,000 | 10ft tall wall | **72** |
| 41 | 2538H4 | NE 80 St | W. Snoqualmie Valley Rd | Ames Lake Carnation Rd | 4200 | Flood | The roadway shoulders washout during flood event and the asphalt has large surface cracks. The roadway subgrade appears to me unstable. | Local | $252,000 | Armor Shoulders @$100/cyd | **72** |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| 42 | 1507G2 | Avondale Rd NE | At NE 151st St | At NE 151st St | 10 | Steep Slopes | The banks of the roadway are unstable near culvert | Principal | $5,000 | Add some rock (Maint Repair) | **74** |
| 43 | 1537G6 | 204 Place NE | SR 202 | Top of Hill | 30 | Land Slide | Bank stabilization is needed. | Local | $30,000 | 10ft tall wall | **74** |
| 44 | 2537J7 | NE 50th St | 214th Ave NE | SR 202 | 1000 | Flood | The roadway is in the Evans Creek flood plain and floods during heavy rains and must be closed. | Local | $60,000 | Armor Shoulders @$100/cyd | **75** |
| 45 | 1507A1 | 148th Ave NE | At 16000 Block | At 16000 Block | 8 | Steep Slopes | The banks of the roadway are unstable | Collector | $10,000 | 3ft tall wall (Maint project) | **77** |
| 46 | 3683H3B | 87th Ave SW | SW Ellisport Rd | SW 207th PL | 100 | Flood | The drainage system around the roadway plugs with leaves | Collector | $100,000 | Routine Maintenance | **77** |
| 47 | 2538H2 | NE 100 St | W. Snoqualmie Valley Rd | 284th Ave NE | 8500 | Flood | The roadway is flood prone and the shoulders washout during the flood events. The asphalt is deteriorating. | Local | $510,000 | Armor Shoulders @$100/cyd | **77** |
| 48 | 1505J6 | Holms Point Drive NE | NE 118th St | NE 116th ST | 1500 | Steep Slopes | The banks of the roadway are unstable | Collector | $900,000 | Walls both sides 10ft tall | **77** |
| 49 | 4838H5 | Mud Mountain Rd | 2900 Block | 2900 Block | 200 | Land Slide | Rock face above roadway drops large amounts of debris onto roadway. | Local | $180,000 | 30' High Wall Needed | **78** |
| 50 | 1507E1 | NE 165th St | 179th Pl NE | 183rd Pl NE | 1540 | Flood | The section of road is flood prone | Collector | $2,000,000 | Road raise with 2 culverts | **82** |
| 51 | 3655H2 | 68th Ave S. | Martin Luther King | Renton City Limits | 1585 | Steep Slopes | There are steep slopes above and below the roadway. The road is very curvy and has a lot of truck traffic. The Renton city limit is at the bottom of the hill. | Collector | $1,902,000 | Walls both sides 20ft tall | **84** |
| 52 | 3713F1 | Governor's Lane | 99th Ave SW | 96th Ave SW | 970 | Seawalls | Seawall of mixed construction types does not protect road from storm wave action. | Local | $2,425,000 | Replace seawall @$2500/ft | **86** |
| 53 | 2514F6 | NE Money Creek Rd | At Money Creek | At Money Creek | 1000 | Land Slide | The hillside above the roadway slides every year | Local | $600,000 | 20ft tall wall | **87** |
| 54 | 2538J3 | 284th Ave NE | NE 100 St | NE Carnation Farm Rd | 2600 | Flood | The roadway is flood prone and the shoulders washout during the flood events. The asphalt is deteriorating. | Local | $156,000 | Armor Shoulders @$100/cyd | **87** |

# Vulnerable Road Segments

| No. | Segment No. (Thos. Bros.) | Road Carried | Segment Start | Segment End | Seg-ment Length | Problem | Description of problem | Road Classi-fication | Construction Costs | Proposed Repair | **Total Rating (low = better candidate)** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 55 | 2599D1 | Neal Rd SE | SR 203 | SR 203 | 16000 | Flood | The roadway shoulder washout during flood events. | Local | $960,000 | Armor Shoulders @$100/cyd | **87** |
| 56 | 3653C4A | West Side Hwy | Crescent Dr SW | Crescent Dr SW | 500 | Roadway Settlement | The roadway sinks several inches each year. | Collector | $400,000 | Rebuild Roadway with New Base | **92** |
| 57 | 3686G6 | SE 224th St | Big Soos Creek | Dead End | 1320 | Land Slide | A landslide caused a section of the road to be closed. One land owner still exists on the end of the roadway near the slide area. | Local | $40,000 | Re-grade end of road | **92** |
| 58 | 2514H6 | Old Cascade Highway | At Miller River | At Miller River | 100 | Flood | The river bank has washed away letting water flow into a culvert that lets water overflow the roadway. This is a school bus route. | Collector | $4,000,000 | Overflow is working as designed | **95** |
| 59 | 3743B1 | Bachelor Rd SW | No Name Spring | No Name Spring | 20 | River Erosion | This culvert needs to be cleaned twice per month due to large amounts of silt being carried by a nearby spring. Sole access. | Local | $500,000 | Possible New Bridge | **96** |
| 60 | 3683A1 | Sunset Rd SW | No Name Spring | No Name Spring | 30 | River Erosion | The culvert under the roadway plugs with silt from a nearby spring every week. Sole access. | Local | $300,000 | Replace With New Structure Designed to Handle Silt | **96** |
| 61 | 3653C4B | Cresent Dr SW | West Side Hwy | SW Cove Rd | 1000 | Roadway Settlement | The roadway sinks several inches each year. | Local | $500,000 | Rebuild Roadway with New Base | **97** |
| 62 | 3683H7 | Kingsbury Beach Rd | SW 234th St | 80th Ave SW | 1600 | Roadway Settlement | The roadway is built on a clay subbase. The area needs to be patched yearly. | Local | $500,000 | Rebuild Roadway with New Base | **97** |
| 63 | 1506B6 | Goat Hill | NE Juanita Dr | Top of Hill | 2700 | Steep Slopes | Single lane sub-standard road with steep grades. Expensive houses with little to zero setback line both sides of road. | Local | $0 | No proposed project due to limited RoW & low ADT | **99** |